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[71] Applicant(s): Beijing Changcheng Dingxing Network Communication Technology Co., Ltd.,
Address: Beijing, China
[72] Inventor(s): Zou Hongbing; Hao Changpeng; Xu Dapeng; Zou Lichun

[74] Patent Agency:
Beijing Beixin-Zhicheng Intellectual Property Agent Co., LTD.

Agent(s): Zhao Yujun

3 pages of Claims, 7 pages of Description and 3 pages of Drawings

[54] **Title:** A Method to Realize Multi-Point Communications by using Serial Bus

[57] **Abstract**

The invention disclosed a method to realize multi-point communications by using serial bus. The method can be applied to a system of cluster network units to realize multi-point communications among network units by using serial bus. The method includes: (A) to establish a master-slaver unit relationship in the physical layer of network system; (B) to establish a basic handshaking relationship between network units in the link layer of network system; (C) to establish a point-to-point communication relationship between network units in the transmission layer of network system; (D) to carry out data transmissions in the application layer of network system according to the format of version number, command and data content. In the invention, master-slaver mode data communications can be realized between network units, for which a serial transmission relationship can be established, so as to realize the centralized remote control and the unified management of network units, in addition, the unified management of digital equipment such as digital household electric appliances can be realized as well.

Claims

1. A method to realize multi-point communications by using serial bus, comprising:

(A) to establish a master-slaver unit relationship in the physical layer of network system;

(B) to establish a basic handshaking relationship between network units in the link layer of network system;

(C) to establish a point-to-point communication relationship between network units in the transmission layer of network system;

(a) data are transmitted between network units according to the following format: version number (8 bits) + destination address (8 bits) + source address (8 bits) + status word (8 bits) + byte length (8 bits) + data bit (n*8 bits) + accumulation and check bit (16 bits);

(b) communication relationships are established between network units according to the following steps:

(1) broadcasting inquiry

the master unit on the bus sends a broadcasting inquiry message to the bus to inquire if there are new units on the bus, wherein the destination addresses of the broadcasting are 0xff;

(2) authentification request

when receiving the broadcasting inquiry message, each unit checks its own ID value; because the initial value of ID address of an un-authentificated unit is zero and the value of ID address of an authentificated unit is non-zero, if the ID value is not zero, the unit has been authentificated; if the ID value is zero, the unit has not been authentificated and needs to carry out the authentification request; the unit which needs to be authentificated generates a random waiting time and checks if there are data transmissions on the bus in the waiting time, if No, the unit sends an authentification inquiry message; if Yes, the unit gives up the authentification for this time and waits for the next broadcasting inquiry;

(3) ID allocation authentification

when receiving the authentification inquiry message, the master unit selects a new ID address in order from the currently idle ID pool and binds the unit information to form an ID allocation message, and then, sends the message in broadcasting;

(4) ID allocation response

each unit on the bus, which has received the ID allocation message, compares the unit information in the message with its own one, if they are consistent, the unit will replace the initial value of zero with the new ID value and send a response message; if they are inconsistent, the unit will abandon the message;

(5) response confirmation

when receiving the response message, the master unit binds the ID and the

information of the unit together and adds them to the ID pool; the ID value and the information of the slaver unit recorded in the master unit are compared with the ID value recorded in the corresponding slaver unit, if they are consistent, the communication between the master unit and the slaver unit will be established;

(c) data are transmitted between network units

(D) to carry out data transmission in the application layer of network system according to the following format:

the data format transmitted in the application layer of network system is classified into three parts of version number, command and data content, and these data are located in the data section of the transmission layer of network system.

2. The method to realize multi-point communications by using serial bus according to Claim 1, wherein the establishment of a master-slaver unit relationship in the physical layer of network system includes following steps:

(1) each management unit in multiple network units to be managed is connected to an independent serial management bus; (2) a master management unit is assigned among these management units, and the master management unit can receive remote management and control information through a network interface, can manage the independent serial management bus, and can transfer the remote management and control information to other management units; (3) other management units, as slaver management units, are controlled by the master management unit on the management bus, receive remote managements and control information sent from the master management unit, and execute corresponding operations.

3. The method to realize multi-point communications by using serial bus according to Claim 2, wherein the data are transmitted in the 9 bits bit-stream in the link layer of network system, the 9th bit of which is used as the identification bit of the lead byte in the data message; if the 9th bit is 1, the byte represents the lead byte in the data message; if the 9th bit is zero, the byte represents the middle data in the data message.

4. The method to realize multi-point communications by using serial bus according to Claim 3, wherein the data transmission between network units in the transmission layer of the network system is based on the master-slaver communication mode, as follows:

1) calling of master unit: after a serial bus communication has been established, a point-to-point link between the master unit and a slaver unit can be realized; when the master unit needs to carry out communication control or information reading with a slaver unit, the master unit gets into master unit calling mode; the master unit adds the unit ID to be communicated with to the destination ID, adds its own ID to the source ID, adds event request type to the command, adds corresponding control information and relevant information to the message, then the message is sent to the bus after the message assembly has been completed;

2) calling response of slaver unit: when a slaver unit in the bus has received a calling message from the master unit, the slaver unit checks the destination ID in the message based on

the correctness of data frame to judge if the ID is in agreement with its own ID, if Yes, next processes are carried out for the message; corresponding operations are executed through the control commands and a new massage is assembled, the response to the control request is made in the message to answer if the operation of the master unit is successful or to provide corresponding inquiry information;

if both above two communications are successful, the one communication is completed, and transmissions are guaranteed by using the connection-oriented communication, therefore, the secure exchange and control of information are realized between the master unit and a slaver unit; this is a standard communication mode in the transmission.

5. The method to realize multi-point communications by using serial bus according to Claim 3, wherein the data transmission between network units in the transmission layer of network system is based on the abnormal event processing mode, as follows:

1) in the bus, the control between the master unit and a slaver unit belongs to master-slaver control mode; when an abnormal event is generated in a slaver unit, the slaver unit should submit the abnormal event immediately to the master unit, and requires corresponding processes; the master unit sends broadcasting information regularly to inquire if there are process requests of abnormal event;

2) when receiving the inquiry, the slaver unit judges if there is an abnormal event to be processed, if Yes, the slaver unit sends a processing request, the event type is classified by the command information, and the event request is also based on the conflict detection competition response;

3) when receiving the request, the master unit sends processing confirmation to inform the slaver unit that the information has been processed, or execute corresponding operations;

4) when receiving the message, the slaver unit executes operations and sends a control response message, so far, the abnormal event processing is completed.

6. The method to realize multi-point communications by using serial bus according to Claim 4 or Claim 5, wherein the data format transmitted in the transmission layer of network system is classified into three parts of version number, command and data content, these data are located in the data section of the transmission layer, as follows:

version number: the version number uses one byte, and defines the basic format of the data in the transmission layer, the version number can be upgraded, once the version number is defined, the interpretation of the data in the transmission layer is determined;

command: the one byte command describes the time request in the data transmission of the application layer; the command is classified into a control command and a response command; when the command uses one byte, the low six series code of the byte is used to represent a communication in each direction, and can be extended to 64 commands, the 7th bit is used to distinguish command types, because the command is classified into two types of a control command and a response command, if the 7th bit is zero, the command represents a control command, if the 7th bit is 1, the command represents a response command; the data redundancy

of two bits can be guaranteed by adopting even parity check mechanism to the 8th bit;

data content: the data content is control transmissions or data responses based on the command, the length of the data content is not fixed, the maximum length is 246 bytes; the data content can be a null, in this case, the message does not transmit any data and only command control will be executed.

Description

A Method to Realize Multi-Point Communications by using Serial Bus

Technical Field

The invention relates to a method to realize multi-point communications, especially relates to a method to realize multi-point communications by using serial bus in a system of cluster network units.

Background Art

With the rapid development of network technology, the scale of network units has increased in an unprecedented speed, which brings an unprecedented burden to the operation and management of network system. At present, to realize a remote management of a network unit in a little system of cluster network units, it is needed for each network unit to have an independent telecommunication system respectively, and each independent telecommunication system is connected to a supervision center through a network channel. The supervision center carries out encode and decode in turn according to the network protocol of each layer to accomplish processing operations of the supervision management information data transmitted in a format of network data package. The shortcoming of this kind of general data transmission and communication mode is: it is more complicated, not economical and not practical to realize. Because the point-to-point mode is mostly adopted in the bus communication, when there are many network units on the network bus, the automatic adding and deleting of the units, and the automatic establishment of communications, and so on, will become more complicated.

Summary of the Invention

To solve above mentioned shortcoming of prior art, the purpose of the invention is to provide a method to realize multi-point communications by using serial bus in a system of cluster network units. The master-slaver mode network system established by the method can realize: the communications among a plurality of units in the network, the plug and play of unit connection without artificial adding and deleting, and the centralized management to network units and digital equipments such as digital household appliances.

To achieve above mentioned purpose, following technical schemes are adopted in the invention:

method to realize multi-point communications by using serial bus, comprising:

(A) to establish a master-slaver unit relationship in the physical layer of network system;

(B) to establish a basic handshaking relationship between network units in the link layer of network system;

(C) to establish a point-to-point communication relationship between network units in the transmission layer of network system;

(a) data are transmitted between network units according to the following format:

version number (8 bits) + destination address (8 bits) + source address (8 bits)

+ status word (8 bits) + byte length (8 bits) + data bit (n*8 bits) + accumulation and check bit (16 bits);

(b) communication relationships are established between network units according to the following steps:

(1) broadcasting inquiry

the master unit on the bus sends a broadcasting inquiry message to the bus to inquire if there are new units on the bus, wherein the destination addresses of the broadcasting are 0xff;

(2) authentification request

when receiving the broadcasting inquiry message, each unit checks its own ID value; because the initial value of ID address of an un-authentificated unit is zero and the value of ID address of an authentificated unit is non-zero, if the ID value is not zero, the unit has been authentificated; if the ID value is zero, the unit has not been authentificated and needs to carry out the authentification request; the unit which needs to be authentificated generates a random waiting time and checks if there are data transmissions on the bus in the waiting time, if No, the unit sends an authentification inquiry message; if Yes, the unit gives up the authentification for this time and waits for the next broadcasting inquiry;

(3) ID allocation authentification

when receiving the authentification inquiry message, the master unit selects a new ID address in order from the currently idle ID pool and binds the unit information to form an ID allocation message, and then, sends the message in broadcasting;

(4) ID allocation response

each unit on the bus, which has received the ID allocation message, compares the unit information in the message with its own one, if they are consistent, the unit will replace the initial value of zero with the new ID value and send a response message; if they are inconsistent, the unit will abandon the message;

(5) response confirmation

when receiving the response message, the master unit binds the ID and the information of the unit together and adds them to the ID pool; the ID value and the information of the slaver unit recorded in the master unit are compared with the ID value recorded in the corresponding slaver unit, if they are consistent, the communication between the master unit and the slaver unit will be established;

(c) data are transmitted between network units

(D) to carry out data transmission in the application layer of network system according to the following format:

the data format transmitted in the application layer of network system is classified into three parts of version number, command and data content, and these data are located in the data section of the transmission layer of network system.

The establishment of a master-slaver unit relationship in the physical layer of network

system includes following steps:

(1) each management unit in multiple network units to be managed is connected to an independent serial management bus; (2) a master management unit is assigned among these management units, and the master management unit can receive remote management and control information through a network interface, can manage the independent serial management bus, and can transfer the remote management and control information to other management units; (3) other management units, as slaver management units, are controlled by the master management unit on the management bus, receive remote managements and control information sent from the master management unit, and execute corresponding operations.

The data are transmitted in the 9 bits bit-stream in the link layer of network system, the 9th bit of which is used as the identification bit of the lead byte in the data message; if the 9th bit is 1, the byte represents the lead byte in the data message; if the 9th bit is zero, the byte represents the middle data in the data message.

The data transmission between network units in the transmission layer of the network system can be based on the master-slaver communication mode, or the abnormal event processing mode.

The master-slaver communication mode is as follows:

1) calling of master unit: after a serial bus communication has been established, a point-to-point link between the master unit and a slaver unit can be realized; when the master unit needs to carry out communication control or information reading with a slaver unit, the master unit gets into master unit calling mode; the master unit adds the unit ID to be communicated with to the destination ID, adds its own ID to the source ID, adds event request type to the command, adds corresponding control information and relevant information to the message, then the message is sent to the bus after the message assembly has been completed;

2) calling response of slaver unit: when a slaver unit in the bus has received a calling message from the master unit, the slaver unit checks the destination ID in the message based on the correctness of data frame to judge if the ID is in agreement with its own ID, if Yes, next processes are carried out for the message; corresponding operations are executed through the control commands and a new massage is assembled, the response to the control request is made in the message to answer if the operation of the master unit is successful or to provide corresponding inquiry information;

if both above two communications are successful, the one communication is completed, and transmissions are guaranteed by using the connection-oriented communication, therefore, the secure exchange and control of information are realized between the master unit and a slaver unit; this is a standard communication mode in the transmission.

The abnormal event processing mode is as follows:

1) in the bus, the control between the master unit and a slaver unit belongs to master-slaver control mode; when an abnormal event is generated in a slaver unit, the slaver unit should submit the abnormal event immediately to the master unit, and requires corresponding processes; the master unit sends broadcasting information regularly to inquire if there are process requests of abnormal event;

2) when receiving the inquiry, the slaver unit judges if there is an abnormal event to be processed, if Yes, the slaver unit sends a processing request, the event type is classified by the command information, and the event request is also based on the conflict detection competition response;

3) when receiving the request, the master unit sends processing confirmation to inform the slaver unit that the information has been processed, or execute corresponding operations;

4) when receiving the message, the slaver unit executes operations and sends a control response message, so far, the abnormal event processing is completed.

The data format transmitted in the transmission layer of network system is classified into three parts of version number, command and data content, these data are located in the data section of the transmission layer, as follows:

version number: the version number uses one byte, and defines the basic format of the data in the transmission layer, the version number can be upgraded, once the version number is defined, the interpretation of the data in the transmission layer is determined;

command: the one byte command describes the time request in the data transmission of the application layer; the command is classified into a control command and a response command; when the command uses one byte, the low six series code of the byte is used to represent a communication in each direction, and can be extended to 64 commands, the 7th bit is used to distinguish command types, because the command is classified into two types of a control command and a response command, if the 7th bit is zero, the command represents a control command, if the 7th bit is 1, the command represents a response command; the data redundancy of two bits can be guaranteed by adopting even parity check mechanism to the 8th bit;

data content: the data content is control transmissions or data responses based on the command, the length of the data content is not fixed, the maximum length is 246 bytes; the data content can be a null, in this case, the message does not transmit any data and only command control will be executed.

In the invention, the master-slaver mode network system is established between network units by using serial bus, and the data transmission is carried out in above mentioned format, therefore, for those network units among which serial transmissions can be established, the master-slaver mode data communication between network units can be realized, and the centralized remote control between network units can be realized to carry out the centralized management to network units, therefore, the network structure is simple, economical and practical.

Brief Description of the Drawings

Fig. 1 shows the data frame format used in the network transmission layer of the invention.

Fig. 2 shows the flow chart of establishing communication relationship in network transmission layer to realize multi-point communications of the invention.

Fig. 3 shows the data frame format used in the network application layer of the invention.

Description of the Preferred Embodiment

The method to utilize multi-point communications by using serial bus in the invention belongs to the half duplex communication mode, that is to say, in a plurality of units of whole communication bus, only one unit carries out transmission, while other units are in the monitor state.

To realize multi-point communications, following steps are adopted in the invention:

1. To establish a master-slaver unit relationship in the physical layer of network system

In whole network system, each management unit in multiple network units to be managed is connected to an independent serial management bus; a master management unit is assigned among these management units, the master management unit can receive remote management and control information through a network interface, can manage the independent serial management bus, and can transfer the remote management and control information to other management units; other management units, as slaver management units, are controlled by the master management unit on the management bus, receive remote managements and control information sent from the master management unit, and execute corresponding operations.

2. To establish a basic handshaking relationship in the link layer of network

Data are transmitted in the electric standard of RS-485. The data transmission adopts the 9 bits bit-stream in the link layer of network system, the 9th bit of which is used as the identification bit of the lead byte in the data message. If the 9th bit is 1, the byte represents the lead byte in the data message; if the 9th bit is zero, the byte represents the middle data in the data message. Because the 9th of data is applied to the identification of the lead byte of data message, the first 8 bytes of data will be explained in the network transmission layer described in following.

3. To establish a point-to-point communication relationship between network units in the link layer of network system

To establish a point-to-point communication relationship, it is defined in the invention that data packets are transmitted between network units according to the following format. As shown in Fig. 1, the data frame format of the invention is: version number (8 bits) + destination address (8 bits) + source address (8 bits)+ status word (8 bits) + byte length (8 bits) + data bit (n*8 bits) + accumulation and check bit (16 bits), in detail:

· Version number: 0bit - 7bit

7bit - 5bit: the three bits are reserved

4 - 0bit: the version number of communication: 00100 SMTP VER 1.0

00101 SMTP VER 2.0

· Destination address: the destination address is the ID serial number of the destination host and is expressed with eight bits, for instance, 0000 1001 represents that the master unit with ID=9 is the destination address to be sent. Special address: 1111 1111 represents broadcasting, that is to say, all slaver units will receive the data packet which concretely commands that the data packet is processed by the master unit or the data packet is submitted to the upper layer protocol to be processed

· Source address: source address is the ID serial number of sender. If the slaver unit is sending ID allocation response, the source address is 0000 0000, which represents that no ID has

been allocated to the unit.

No matter destination address or source address, if two high bits are 11, the address represents a server with the management authority, if two high bits are 00, the address represents a client without the administration authority.

· Status word:

7bit: reserved

6bit: reserved

5bit: flag bit of full duplex communication

1: the full duplex communication mode

0: the half duplex communication mode

4bit: flag bit of that response is not necessary

1: response is not necessary

0: response is necessary

3bit: flag bit of starting message

1: to represent it is first transmitted message, when data are sent by segmentations

0: to represent it is not starting message

2bit: flag bit of last message

1: to represent it is last transmitted message, when data are sent by segmentations

0: to represent it is not last message

1 - 0bit: flag bit of service priority

The service priority is divided into four levels, the highest level is 11, and the lowest level is 00. The message of high priority is processed in preference.

· Byte length: to represent the total length of whole data packets, the maximum length is 255 bytes.

· Data section: data content of application layer

· Check bit: to adopt accumulation and check, use bytes, accumulate each byte for whole data message, if exceeding 16, taking place high bit overflow.

As shown in Fig. 2, the multi-point communications is realized by using serial bus in the invention, and to establish communication relationship between network units in the network transmission layer, it is needed to carry out following steps:

(1) Broadcasting inquiry:

The master unit on the bus sends a broadcasting inquiry message to the bus to inquire if there are new units on the bus, wherein the destination addresses of the broadcasting are 0xff.

(2) Authentification request:

When receiving the broadcasting inquiry message, each unit checks its own ID value; because the initial value of ID address of an un-authentificated unit is zero and the value of ID address of an authentificated unit is non-zero, if the ID value is not zero, the unit has been authentificated; if the ID value is zero, the unit has not been authentificated and needs to carry out the authentification request; the unit which needs to be authentificated generates a random waiting time and checks if there are data transmissions on the bus in the waiting time, if No, the unit sends an authentification inquiry message; if Yes, the unit gives up the authentification for

this time and waits for the next broadcasting inquiry.

(3) ID allocation authentification:

When receiving the authentification inquiry message, the master unit selects a new ID address in order from the currently idle ID pool and binds the unit information to form an ID allocation message, and then, sends the message in broadcasting.

(4) ID allocation response:

each unit on the bus, which has received the ID allocation message, compares the unit information in the message with its own one, if they are consistent, the unit will replace the initial value of zero with the new ID value and send a response message; if they are inconsistent, the unit will abandon the message.

(5) Response confirmation:

When receiving the response message, the master unit binds the ID and the information of the unit together and adds them to the ID pool; the ID value and the information of the slaver unit recorded in the master unit are compared with the ID value recorded in the corresponding slaver unit, if they are consistent, the communication between the master unit and the slaver unit will be established.

After above mentioned communication relationship has been established, data will be transmitted between network units in mainly following two modes:

First mode: master-slaver communication mode:

1) Calling of master unit: after a serial bus communication has been established, a point-to-point link between the master unit and a slaver unit can be realized; when the master unit needs to carry out communication control or information reading with a slaver unit, the master unit gets into master unit calling mode; the master unit adds the unit ID to be communicated with to the destination ID, adds its own ID to the source ID, adds event request type to the command, adds corresponding control information and relevant information to the message, then the message is sent to the bus after the message assembly has been completed.

2) Calling response of slaver unit: when a slaver unit in the bus has received a calling message from the master unit, the slaver unit checks the destination ID in the message based on the correctness of data frame to judge if the ID is in agreement with its own ID, if Yes, next processes are carried out for the message; corresponding operations are executed through the control commands and a new massage is assembled, the response to the control request is made in the message to answer if the operation of the master unit is successful or to provide corresponding inquiry information.

If both above two communications are successful, the one communication is completed, and transmissions are guaranteed by using the connection-oriented communication, therefore, the secure exchange and control of information are realized between the master unit and a slaver unit; this is a standard communication mode in the transmission.

Second mode: abnormal event processing mode:

1) In the bus, the control between the master unit and a slaver unit belongs to master-slaver control mode; when an abnormal event is generated in a slaver unit, the slaver unit should submit the abnormal event immediately to the master unit, and requires corresponding processes; the

master unit sends broadcasting information regularly to inquire if there are process requests of abnormal event.

2) When receiving the inquiry, the slaver unit judges if there is an abnormal event to be processed, if Yes, the slaver unit sends a processing request, the event type is classified by the command information, and the event request is also based on the conflict detection competition response.

3) When receiving the request, the master unit sends processing confirmation to inform the slaver unit that the information has been processed, or execute corresponding operations.

4) When receiving the message, the slaver unit executes operations and sends a control response message, so far, the abnormal event processing is completed.

This kind of communication mode can submit the information data to the master unit in a may of conflict detection competition through master unit's regular repeating inquiry so that the abnormal event is processed in time when a slaver unit has an abnormal event to be processed.

4. To carry out data transmissions in the application layer of network systems:

When the communication relationship has been established between network units according to above mentioned method, the data is transmitted in the following format as shown in Fig. 3. The data format transmitted in the transmission layer of network system is classified into three parts of version number, command and data content, these data are located in the data section of the transmission layer, as follows:

Version number: the version number uses one byte, and defines the basic format of the data in the transmission layer, the version number can be upgraded, once the version number is defined, the interpretation of the data in the transmission layer is determined.

Command: the one byte command describes the time request in the data transmission of the application layer; the command is classified into a control command and a response command; when the command uses one byte, the low six series code of the byte is used to represent a communication in each direction, and can be extended to 64 commands, the 7th bit is used to distinguish command types, because the command is classified into two types of a control command and a response command, if the 7th bit is zero, the command represents a control command, if the 7th bit is 1, the command represents a response command; the data redundancy of two bits can be guaranteed by adopting even parity check mechanism to the 8th bit.

Data content: the data content is control transmissions or data responses based on the command, the length of the data content is not fixed, the maximum length is 246 bytes; the data content can be a null, in this case, the message does not transmit any data and only command control will be executed.

In the invention, the master-slaver mode network system is established between network units by using serial bus, and the data transmission is carried out in above mentioned format, for those network units among which serial transmissions can be established, the master-slaver mode data communication between network units can be realized, and the centralized remote control between network units can be realized to carry out the centralized management to network units, therefore, the network structure is simple, economical and practical.

A standardized protocol interface can be established by utilizing the method described in the

invention, so as to realize access management of network units based on the standard protocol interface in different development systems. In addition, the transmission layer and the application layer of the invention protocol have a protocol version number, respectively, it is possible to transmit data with different version numbers in a same serial bus through upgrading protocol version, and the protocol has a downward compatibility and very strong expansibility.

Translation for Drawings

Fig.1

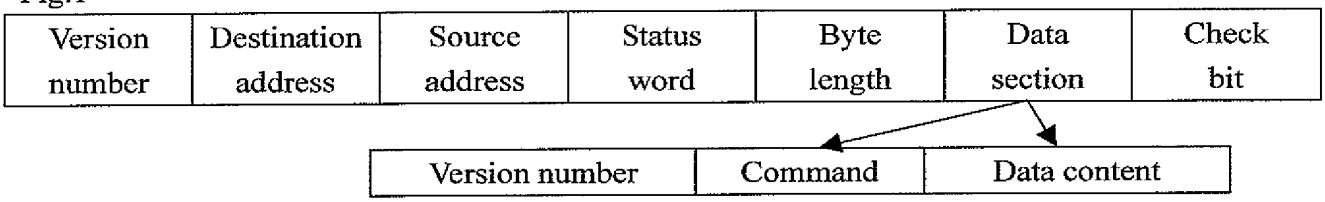


Fig.2

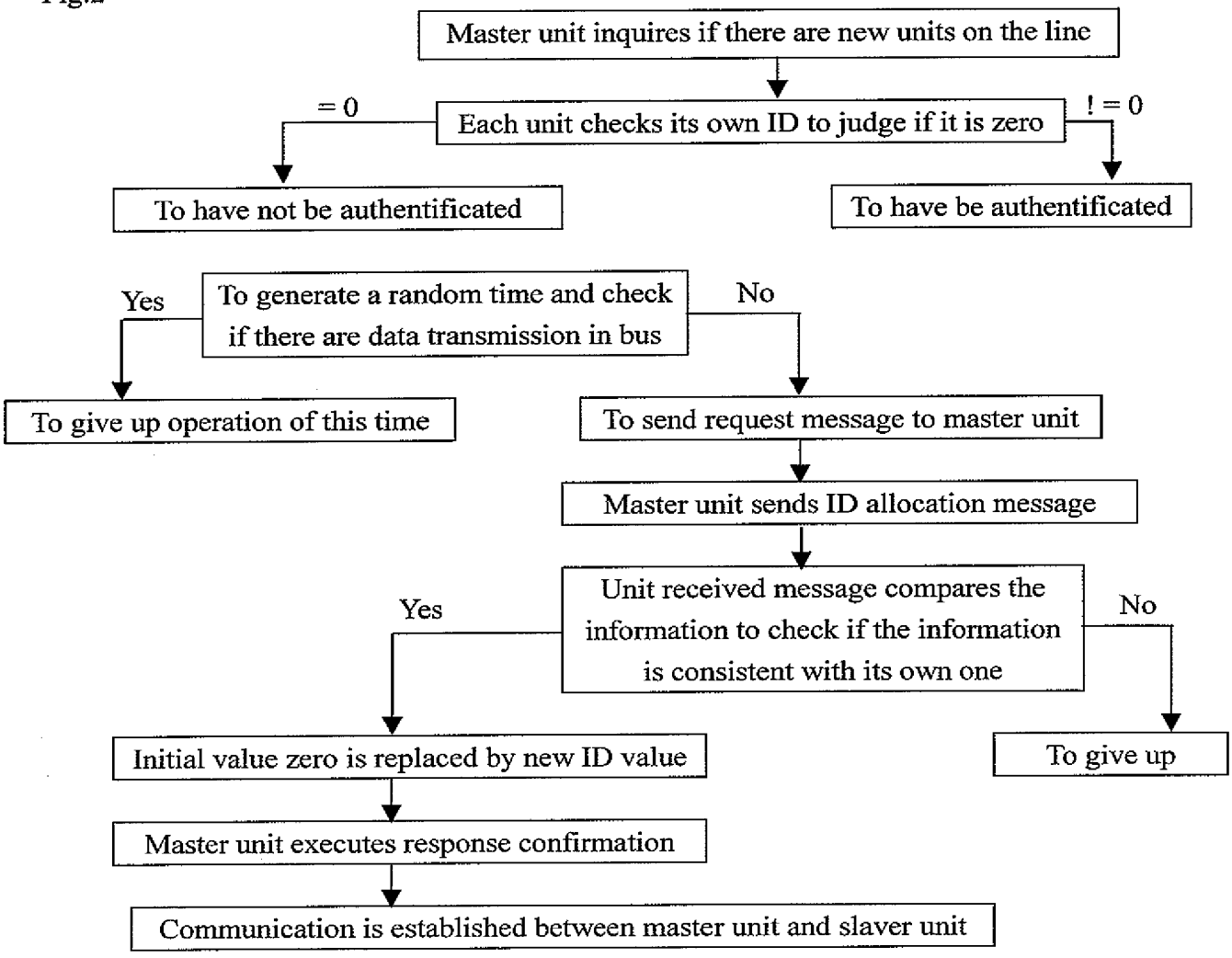
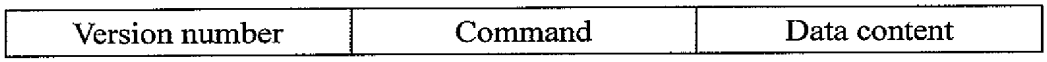


Fig. 3



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[71] 申请人 北京长城鼎兴网络通信技术有限公司
地址 100083 北京市海淀区学院路甲 38 号长城电脑大厦 *A*301 室
[72] 发明人 邹红兵 郝长鹏 徐大鹏 邱立纯

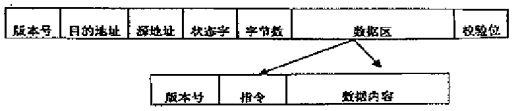
[74] 专利代理机构 北京北新智诚专利代理有限公司
代理人 赵郁军

权利要求书 3 页 说明书 7 页 附图 3 页

[54] 发明名称 一种利用串行总线实现多点通信的方法

[57] 摘要

本发明公开了一种利用串行总线实现多点通信的方法，该方法可在集群式网络设备系统中，运用串行总线实现设备间的多点通讯。该方法包括以下步骤：(*A*) 在网络的物理层建立主从设备关系；(*B*) 在网络的链路层建立设备间基本的握手关系；(*C*) 在网络的传输层，建立设备间点对点的通信关系；(*D*) 在网络的应用层按照版本号，指令和数据内容的格式进行数据传输。本发明对能够建立串行传输关系的设备，可以实现设备间的主从式数据通信，从而实现设备的集中远程控制，网络设备的统一管理，也可以实现信息家电等信息设备的统一管理。



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1、一种利用串行总线实现多点通信的方法，它包括以下步骤：

（A）在网络的物理层建立主从设备关系；

（B）在网络的链路层建立设备间基本的握手关系；

（C）在网络的传输层，建立设备间点对点的通信关系；

（a）、设备间按以下数据格式进行数据传输：

8位版本号＋8位目的地址＋8位源地址＋8位状态字＋8位字节数＋n*8数据位+16位累加和校验位；

(b)、设备间按以下步骤建立通信关系：

①、广播询问

总线上的主控设备向总线发送广播询问报文，询问是否有新设备上线，广播的目的地址是0xff；

②、认证请求

各设备接收到广播询问报文后，检查自己的ID值：由于未经认证的设备初始ID地址是0，而经过认证的设备ID地址非0，所以，如果ID值不等于0，则该设备已经经过认证；如ID值等于0,则该设备没有经过认证，需要进行认证请求；需要请求认证的设备，产生一个随机等待时间，在该时间内检测总线中是否有数据传输，如果在此时间内没有数据传输，则发送认证请求报文；如果有数据传输，则放弃本次认证操作，等待下次广播询问；

③、ID分配认证

当主控设备接收到认证请求报文后，则在当前空闲的ID池中依次选择一个新的ID，并且绑定该设备的设备信息，构成ID分配报文，以广播的形式发送出去；

④、ID分配应答

总线中所有得到ID分配报文的设备，比较该报文的设备信息是否与自己一致，如果一致，则把新的ID值替换初始的零值，并发送应答报文；如果不一致，将做丢弃处理；

⑤、应答确认

当主控设备接收到应答报文以后，将该设备的ID与设备信息绑定并添加到ID池中；将主控设备所记录的从控设备信息及ID值与相应的从控设备所记录的ID值比较，如果一致，则主控设备与从控设备的通信就建立起来；

(c)、设备间进行数据传输

（D）、在网络的应用层按照以下格式进行数据传输；

在网络应用层传输的数据格式分为版本号，指令和数据内容三部分，它位于传输层数据区部分。

2、根据权利要求 1 所述的一种利用串行总线实现多点通信的方法，其特征在于：在网络的物理层建立主从设备关系，包括以下步骤：

①用一根独立的串行管理总线将被管理的多台网络设备的各管理单元进行联接；②在这些管理单元中设定一个主控管理单元，该主控管理单元可以通过网络接口接收远程的管理控制信息，并对独立串行管理总线进行管理，向其它管理单元转发远程管理控制信息；③其余的管理单元作为从控管理单元，在管理总线上接受主控管理单元的控制，接收由主控管理单元转发的远程管理控制信息，并执行相应的操作。

3、根据权利要求 2 所述的一种利用串行总线实现多点通信的方法，其特征在于：在网络的链路层，数据采用九位比特流的方式进行传输，第九位作为数据报文首字节的识别位；如果第九位是一，则代表该字节是数据报文的首字节；如果是零，代表是数据报文的中间数据。

4、根据权利要求 3 所述的一种利用串行总线实现多点通信的方法，其特征在于：在网络的传输层，设备间数据传输的方式为：主从通信方式；

所述主从通信方式为：

1)主控设备呼叫：当串行总线通信方式建立起来以后，主控设备与从控设备就可以实现点对点的联接；当主控设备需要和某一从控设备进行通信控制或信息读取的时候，则进入主控呼叫模式；主控设备把将要与之通信的设备 ID 添加到目的 ID 中，把自己的 ID 添加到源 ID 中，把事件请求类型添加到指令中，并添加相应的控制信息和相关信息，报文组装完毕后，向总线中发送报文；

2)从控设备呼叫应答：当总线中的从控设备接收到主控呼叫报文以后，在保证数据帧正确的基础上判断该报文的目的 ID 是否与自己的 ID 一致，如果一致则对报文进行下一步的处理进程；通过控制指令执行相应的操作，并组装新的报文，在报文中对控制请求做出应答，应答主控设备操作是否成功或提交相应的询问信息；

两次通信均成功，则一次通信完毕，采用面向联结的通信方式，使传输得到保证，从而实现了主从设备间的信息安全交换、控制；这种方式是该传输方式下的标准通信方式。

5、根据权利要求 3 所述的一种利用串行总线实现多点通信的方法，其特征在于：在网络的传输层，设备间数据传输的方式为：异常事件处理方式；

所述异常事件处理方式：

1)在该总线中，主控设备与从控设备间为主从式控制方式；当从控设备产生异

常事件时，需要及时提交给主控设备，并申请相应的处理；主控设备定时发送广播信息，询问是否有异常处理请求；

2)当从控设备接收到请求以后，判断是否有异常事件需要处理，如果异常事件，则发出处理请求，通过指令信息来区分事件类型，该事件的请求也是通过冲突检测竞争应答方式；

3)当主控设备接收到该请求以后，则发出处理认证，通知从控设备该信息已经处理或执行相应的操作；

4)从控设备接收到信息以后，执行操作并发出控制应答报文，异常事件处理完毕。

6、根据权利要求 4 或 5 所述的一种利用串行总线实现多点通信的方法，其特征在于：在网络应用层传输的数据格式分为版本号，指令和数据内容三个部分，它位于传输层数据区部分；

版本号：一个字节，它定义了应用层数据的基本格式 ，版本号可以升级，当版本号被定义下来以后，则应用层数据的解析将是固定的；

指令：一个字节指令是描述应用层数据传输中的时间请求；指令分为控制指令和应答指令；当指令类型采用的是一个字节时，该字节的低六位顺序编码，表示每一个方向的通信，可以扩充到 64 条指令；该字节的第七位用来区分指令类型，由于指令分为控制指令和应答指令两种，所以，如果第七位是 0，表示是控制指令,如果为 1 表示是应答指令；对于第 8 位，采用偶校验机制，可以保证两位的数据冗余；

数据内容：数据内容是基于该指令下控制传输或数据应答的内容，数据内容的长度是不固定的，最大长度为 246 个字节；数据内容也可以是空，则表示该报文不传输数据只进行指令控制。

一种利用串行总线实现多点通信的方法

技术领域

本发明涉及一种实现多点通信的方法，尤指一种在集群式网络设备系统中，利用串行总线实现多点通信的方法。

背景技术

随着网络技术的飞速发展，网络设备的增长速度也达到了前所未有的程度，这给网络的运营管理带来了前所未有的负担。目前，在小集群式网络设备系统中，如果要实现设备的远程管理，每个设备需要有各自独立的远程通信系统，各个独立的远程通信系统再通过网络通道与监管中心相连。监管中心按照各层的网络协议，依次编/解码完成以网络数据包形式传递的监控管理信息数据的处理操作。这种通用的数据传输、通信方式的缺点是：实现起来比较复杂、不够经济实用。因为在总线通信方式上，多是采用点对点的方式，当网络总线上有多个设备时，对于设备的自动添加、删除、通信的自动建立等，解决起来将变的比较复杂。

发明内容

为了解决上述现有技术的缺陷，本发明的目的是提供一种用于集群式网络设备系统中的、利用串行总线实现多点通信的方法。通过该方法建立的主从式网络系统，可实现网络中多个设备间的通信，能够实现设备接入的即插即用，不用人为添加、删除，并可对网络设备进行统一管理，也可以实现信息家电等信息设备的统一管理。

为实现上述目的，本发明采用以下技术方案：一种利用串行总线实现多点通信的方法，它包括以下步骤：

（A）在网络的物理层建立主从设备关系；

（B）在网络的链路层建立设备间基本的握手关系；

（C）在网络的传输层，建立设备间点对点的通信关系；

（a）、设备间按以下数据格式进行数据传输：

8位版本号＋8位目的地址＋8位源地址＋8位状态字＋8位字节数＋n*8 数据位+16 位累加和校验位；

(b)、设备间按以下步骤建立通信关系：

①、广播询问

总线上的主控设备向总线发送广播询问报文，询问是否有新设备上线，广播的目的地址是 0xff；

②、认证请求

各设备接收到广播询问报文后，检查自己的 ID 值；由于未经认证的设备初始 ID 地址是 0，而经过认证的设备 ID 地址

所述主从通信方式为：

1)主控设备呼叫：当串行总线通信方式建立起来以后，主控设备与从控设备就可以实现点对点的联接；当主控设备需要和某一从控设备进行通信控制或信息读取的时候，则进入主控呼叫模式；主控设备把将要与之通信的设备 ID 添加到目的 ID 中，把自己的 ID 添加到源 ID 中，把事件请求类型添加到指令中，并添加相应的控制信息和相关信息，报文组装完毕后，向总线中发送报文；

2)从控设备呼叫应答：当总线中的从控设备接收到主控呼叫报文以后，在保证数据帧正确的基础上判断该报文的目的 ID 是否与自己的 ID 一致，如果一致则对报文进行下一步的处理进程；通过控制指令执行相应的操作，并组装新的报文，在报文中对控制请求做出应答，应答主控设备操作是否成功或提交相应的询问信息；

两次通信均成功，则一次通信完毕，采用面向联结的通信方式，使传输得到保证，从而实现了主从设备间的信息安全交换、控制；这种方式是该传输方式下的标准通信方式。

所述异常事件处理方式：

1)在该总线中，主控设备与从控设备间为主从式控制方式；当从控设备产生异常事件时，需要及时提交给主控设备，并申请相应的处理；主控设备定时发送广播信息，询问是否有异常处理请求；

2)当从控设备接收到请求以后，判断是否有异常事件需要处理，如果异常事件，则发出处理请求，通过指令信息来区分事件类型，该事件的请求也是通过冲突检测竞争应答方式；

3)当主控设备接收到该请求以后，则发出处理认证，通知从控设备该信息已经处理或执行相应的操作；

4)从控设备接收到信息以后，执行操作并发出控制应答报文，异常事件处理完毕。

在网络应用层传输的数据格式分为版本号，指令和数据内容三个部分，它位于传输层数据区部分；

版本号：一个字节，它定义了应用层数据的基本格式 ，版本号可以升级，当版本号被定义下来以后，则应用层数据的解析将是固定的；

指令：一个字节指令是描述应用层数据传输中的时间请求；指令分为控制指令和应答指令；当指令类型采用的是一个字节时，该字节的低六位顺序编码，表示每一个方向的通信，可以扩充到 64 条指令；该字节的第七位用来区分指令类型，由于指令分为控制指令和应答指令两种，所以，如果第七位是 0，表示是控制指令,如果为 1 表示是应答指令；对于第 8 位，采用偶校验机制，可以保证两位的数据冗余；

数据内容：数据内容是基于该指令下控制传输或数据应答的内容，数据内容的长度是不固定的，最大长度为 246 个字节；数据内容也可以是空，则表示该报文不

非 0，所以，如果 ID 值不等于 0，则该设备已经经过认证；如 ID 值等于 0,则该设备没有经过认证，需要进行认证请求；需要请求认证的设备，产生一个随机等待时间，在该时间内检测总线中是否有数据传输，如果在此时间内没有数据传输，则发送认证请求报文；如果有数据传输，则放弃本次认证操作，等待下次广播询问；

③、ID 分配认证

当主控设备接收到认证请求报文后，则在当前空闲的 ID 池中依次选择一个新的 ID，并且绑定该设备的设备信息，构成 ID 分配报文，以广播的形式发送出去；

④、ID 分配应答

总线中所有得到 ID 分配报文的设备，比较该报文的设备信息是否与自己一致，如果一致，则把新的 ID 值替换初始的零值，并发送应答报文；如果不一致，将做丢弃处理；

⑤、应答确认

当主控设备接收到应答报文以后，将该设备的 ID 与设备信息绑定并添加到 ID 池中；将主控设备所记录的从控设备信息及 ID 值与相应的从控设备所记录的 ID 值比较，如果一致，则主控设备与从控设备的通信就建立起来；

(c)、设备间进行数据传输

（D）、在网络的应用层按照以下格式进行数据传输：

在网络应用层传输的数据格式分为版本号，指令和数据内容三部分，它位于传输层数据区部分。

在网络的物理层建立主从设备关系，包括以下步骤：

①用一根独立的串行管理总线将被管理的多台网络设备的各管理单元进行联接；②在这些管理单元中设定一个主控管理单元，该主控管理单元可以通过网络接口接收远程的管理控制信息，并对独立串行管理总线进行管理，向其它管理单元转发远程管理控制信息；③其余的管理单元作为从控管理单元，在管理总线上接受主控管理单元的控制，接收由主控管理单元转发的远程管理控制信息，并执行相应的操作。

在网络的链路层，数据采用九位比特流的方式进行传输，第九位作为数据报文首字节的识别位；如果第九位是一，则代表该字节是数据报文的首字节；如果是零，代表是数据报文的中间数据。

在网络的传输层，设备间数据传输的方式为可以为主从通信方式，也可以为异常事件处理方式；

传输数据只进行指令控制。

本发明利用串行总线方式在设备间建立主从式网络系统，并按照以上格式进行数据传输，对于能够建立串行传输方式的设备之间，可以实现设备间的主从式数据通信，实现设备间的集中远程控制，对网络设备进行统一的管理，网络结构简单、经济使用。

附图说明

图 1 为本发明网络传输层采用的数据帧格式

图 2 为本发明实现多点通信在网络传输层建立通信关系的程序框图

图 3 为本发明网络应用层采用的数据帧格式

具体实施方式

本发明利用串行总线实现多点传输通信的方法属于半双工通信方式，即在整个通信总线的多个设备中，只有一个设备进行传输，其他设备处于监听状态。

为实现多点通讯，本发明采用以下步骤：

1、在网络的物理层建立主从设备关系

在整个网络系统中，用一根独立的串行管理总线将被管理的多台网络设备的各管理单元进行联接；在这些管理单元中设定一个主控管理单元，该主控管理单元可以通过网络接口接收远程的管理控制信息，并对独立串行管理总线进行管理，向其它管理单元转发远程管理控制信息；其余的管理单元作为从控管理单元，在管理总线上接受主控管理单元的控制，接收由主控管理单元转发的远程管理控制信息，并执行相应的操作。

2、在网络的链路层建立基本的握手关系

数据在 RS-485 的电气规范中进行传输。数据的传输采用九位比特流的方式，第九位作为数据报文首字节的识别位。如果第九位是一，则代表该字节是数据报文的首字节；如果是零，代表是数据报文的中间数据。由于数据的第九位应用于报文首字节的鉴别，因此，在下面叙述的网络传输层，将只对数据前八位进行说明。

3、在网络的传输层，建立设备间点对点的通信关系

为了建立点对点的通信关系，本发明规定设备间按照以下格式传输数据包。如图 1 所示，本发明的数据帧格式为：8 位版本号＋8 位目的地址＋8 位源地址＋8 位状态字＋8 位字节数＋n*8 数据位+16 位累加和校验位。具体说明如下：

◆版本号：0bit-7bit

7bit-5bit： 该三位保留

4-0bit： 通信的版本号：00100 SMTP VER 1.0

00101 SMTP VER 2.0

◆目的地址：目的地址是目的主机的 ID 编号，用八位数据表示。如 0000 1001 表示 ID=9 的主控设备将是被发送目标地址。特殊地址：若是 1111 1111 则表示广播，

即所有的从控设备都将接收该数据包，该数据包具体指令是否被该主控设备所处理，将提交到上层协议来进行处理。

◆源地址：是发送方的 ID 编号。如果该从控设备正在发送 ID 分配应答，则源地址为 0000 0000，表示本机并没有给分配 ID。

无论是目的地址还是源地址，如果高二位是 11，则代表是服务器，具有管理权限，如果是 00 代表是客户机不具有管理权限。

◆状态字：

7bit：保留

6bit：保留

5bit：全双工标志位

1：全双工通信方式

0：半双工通信方式

4bit：不需要应答标志位

1：不需要应答

0：需要应答

3bit：起始报文标志位

1：数据被分段发送的时候，表示是第一个传送的报文

0：代表不是起始报文

2bit：最末报文标志位

1：数据被分段发送的时候，表示是最后一个传送的报文

0：代表不是最后一个报文

1-0 bit：服务优先级标志位

分为四个优先级，最高的为 11，最低的为 00。级别高，该报文就优先被处理。

◆字节数：表示整个数据包的总长度，最大长度为 255 个字节。

◆ 数据区：应用层数据内容

◆校验位：采用累加和校验，采用二个字节，对整个数据报的每个字节进行累加，超过 16 位，高位溢出。

如图 2 所示，本发明利用串行总线实现多点通信，为了在网络传输层，设备间建立通信关系需执行以下步骤：

①、广播询问：

总线上的主控设备向总线发送广播询问报文，询问是否有新设备上线，广播的目的地址是 0xff。

②、认证请求：

各设备接收到广播询问报文后，检查自己的 ID 值；由于未经认证的设备初始 ID 地址是 0，而经过认证的设备 ID 地址非 0，所以，如果 ID 值不等于 0，则该设备已

经经过认证；如 ID 值等于 0,则该设备没有经过认证，需要进行认证请求；

需要请求认证的设备，产生一个随机等待时间，在该时间内检测总线中是否有数据传输，如果在此时间内没有数据传输，则发送认证请求报文；如果有数据传输，则放弃本次认证操作，等待下次广播询问。

③、ID 分配认证：

当主控设备接收到认证请求报文后，则在当前空闲的 ID 池中依次选择一个新的 ID，并且绑定该设备的设备信息，构成 ID 分配报文，以广播的形式发送出去。

④、ID 分配应答：

总线中所有得到 ID 分配报文的设备，比较该报文的设备信息是否与自己一致，如果一致，则把新的 ID 值替换初始的零值，并发送应答报文；如果不一致，将做丢弃处理。

⑤、应答确认：

当主控设备接收到应答报文以后，将该设备的 ID 与设备信息绑定并添加到 ID 池中。将主控设备所记录的从控设备信息及 ID 值与相应的从控设备所记录的 ID 值比较，如果一致，则主控设备与从控设备的通信就建立起来。

当设备间建立起上述通信关系后，数据即开始在设备间进行传输，数据传输的方式主要有两种：

一种：主从通信方式：

1)主控设备呼叫：当串行总线通信方式建立起来以后，主控设备与从控设备就可以实现点对点的联接。当主控设备需要和某一从控设备进行通信控制或信息读取的时候，则进入主控呼叫模式。主控设备把将要与之通信的设备 ID 添加到目的 ID 中，把自己的 ID 添加到源 ID 中，把事件请求类型添加到指令中，并添加相应的控制信息和相关信息，报文组装完毕后，向总线中发送报文。

2) 从控设备呼叫应答：当总线中的从控设备接收到主控呼叫报文以后，在保证数据帧正确的基础上判断该报文的目的 ID 是否与自己的 ID 一致，如果一致则对报文进行下一步的处理进程。通过控制指令执行相应的操作，并组装新的报文，在报文中对控制请求做出应答，应答主控设备操作是否成功或提交相应的询问信息。

两次通信均成功，则一次通信完毕，采用面向联结的通信方式，使传输得到保证，从而实现了主从设备间的信息安全交换、控制。这种方式是该传输方式下的标准通信方式。

第二种：异常事件处理方式：

1)在该总线中，主控设备与从控设备间为主从式控制方式。当从控设备产生异常事件时，需要及时提交给主控设备，并申请相应的处理。主控设备定时发送广播信息，询问是否有异常处理请求。

2)当从控设备接收到请求以后，判断是否有异常事件需要处理，如果异常事件，

则发出处理请求，通过指令信息来区分事件类型，该事件的请求也是通过冲突检测竞争应答方式。

3)当主控设备接收到该请求以后，则发出处理认证，通知从控设备该信息已经处理或执行相应的操作。

4)从控设备接收到信息以后，执行操作并发出控制应答报文，异常事件处理完毕。

这种通信方式，解决了当从控设备有异常事件产生需要处理的时候，通过主控设备的定时轮询可以把信息通过冲突检测竞争的方式把数据提交给主控设备，从而得到及时处理。

4、在网络的应用层进行数据传输：

当设备间按照上述方法建立起通信关系后，在据按照以下格式进行传输，如图 3 所示，该数据格式网络的应用层数分为版本号，指令和数据内容三个部分，它位于传输层数据区部分；

版本号：一个字节，它定义了应用层数据的基本格式 ，版本号可以升级，当版本号被定义下来以后，则应用层数据的解析将是固定的。

指令：一个字节指令是描述应用层数据传输中的时间请求。指令分为控制指令和应答指令。当指令类型采用的是一个字节时，该字节的低六位顺序编码，表示每一个方向的通信，可以扩充到 64 条指令；该字节的第七位用来区分指令类型，由于指令分为控制指令和应答指令两种，所以，如果第七位是 0，表示是控制指令,如果为 1 表示是应答指令；对于第 8 位，采用偶校验机制，可以保证两位的数据冗余。

数据内容：数据内容是基于该指令下控制传输或数据应答的内容，数据内容的长度是不固定的，最大长度为 246 个字节。数据内容也可以是空，则表示该报文不传输数据只进行指令控制。

本发明利用串行总线方式在设备间建立主从式网络系统，并按照以上格式进行数据传输，对于能够建立串行传输方式的设备之间，可以实现设备间的主从式数据通信，实现设备间的集中远程控制，对网络设备进行统一的管理，网络结构简单、经济使用。

运用本发明所述的方法可建立标准化的协议接口，从而在不同的开发体系中，依据标准的协议接口将会实现设备的接入管理。另外，在本发明协议的传输层和应用层各有一个协议版本号，通过对协议版本的升级可实现在同一个串行总线上不同版本协议的数据传输，并且能够做到向下兼容，具有很强的扩展性。

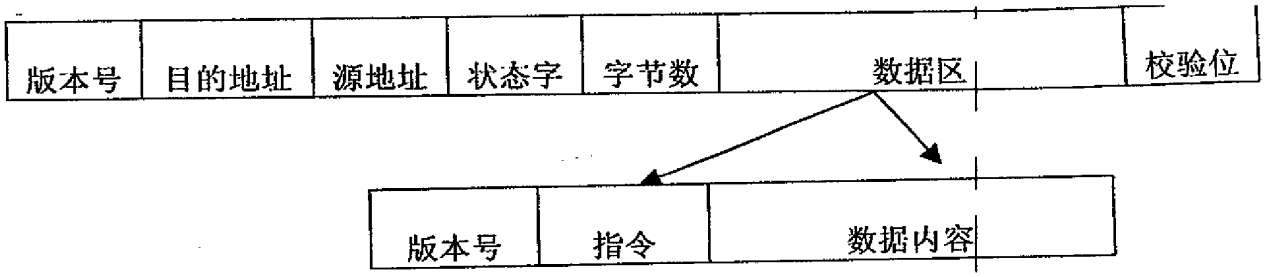

图 1

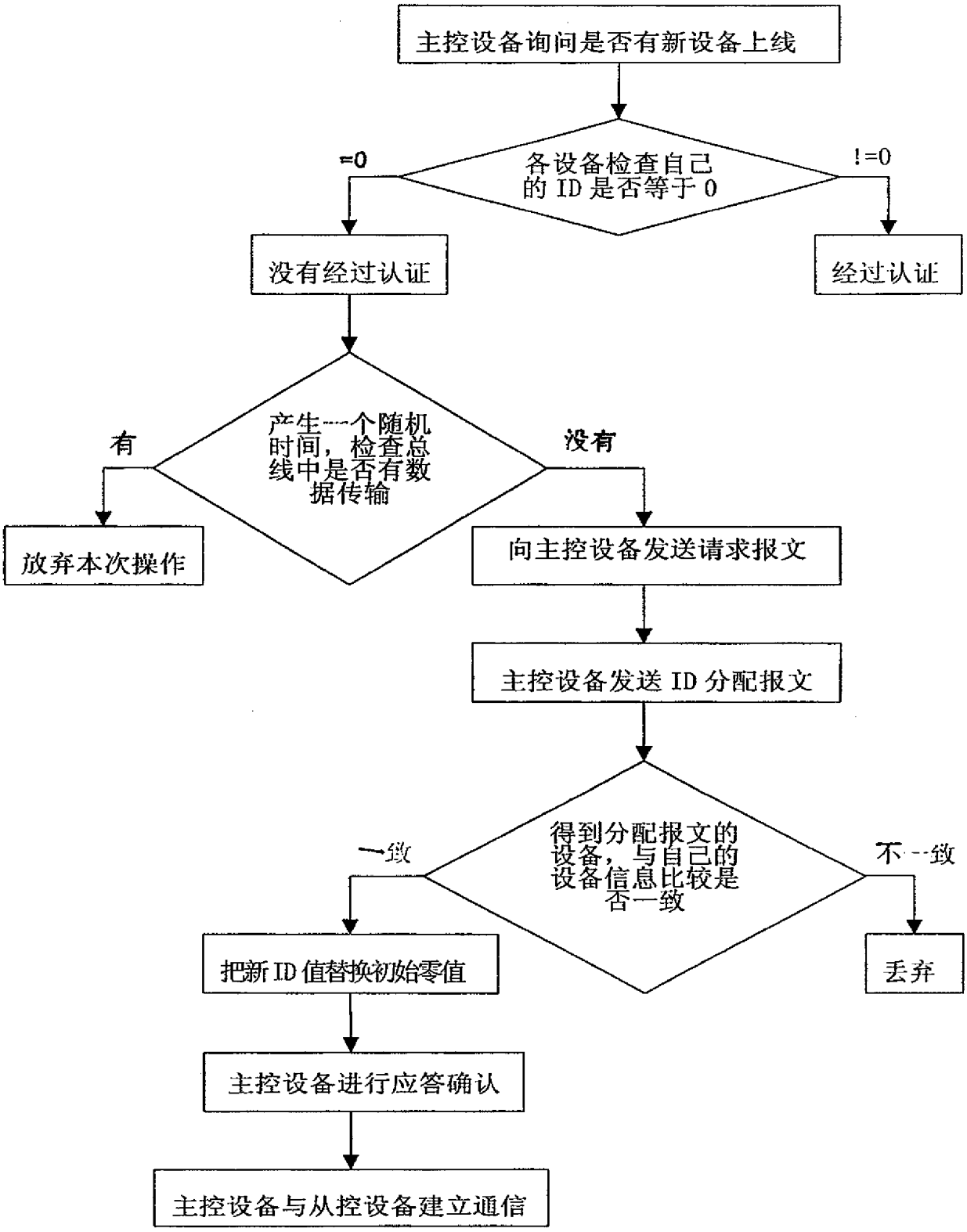
主控设备询问是否有新设备上线
各设备检查自己的 ID 是否等于 0
=0
!=0
没有经过认证
经过认证
产生一个随机时间，检查总线中是否有数据传输
有
没有
放弃本次操作
向主控设备发送请求报文
主控设备发送 ID 分配报文
得到分配报文的设备，与自己的设备信息比较是否一致
一致
不一致
把新 ID 值替换初始零值
丢弃
主控设备进行应答确认
主控设备与从控设备建立通信

图 2

图 3